ENGE 2022 abstract – Invited Talk – Topic 1-4. Compound Semiconductors and Power Electronic Devices

Gallium Nitride Power Devices for Power Conversion Applications

Julien Buckley[1]*, René Escoffier[1], Blend Mohamad[1], Stéphane Bécu[1], Jérôme Biscarrat[1], Florian Rigaud-Minet[1], Laura Vauche[1], Vishwajeet Maurya[1], Matthew Charles[1], Helge Haas[1], Mohamed-reda Irekti[1], Murielle Fayolle-Lecocq[1], Jérémy Martin[2], Van-Sang Nguyen[2], Cyrille Le Royer[1], Romain Gwoziecki[1], Charlotte Gillot[1], Véronique Sousa[1]

[1]University of Grenoble Alpes, F-38000 Grenoble, France and CEA, LETI, MINATEC Campus, F-38054 Grenoble, France,
[2]Laboratory of Intelligent Management of Electrical Network (LIRE), Department of Solar Technologies (DTS), LITEN, CEA Grenoble, 73370 Le Bourget du Lac, France
*julien.buckley@cea.fr

This presentation will deal with our work on gallium nitride (GaN) devices for power electronics. The breakdown field of GaN is around 3.3 MV/cm and its mobility can surpass 1000 cm^2/V.s, making it an excellent candidate for power switches. The lateral HEMT (High Electron Mobility Transistor) architecture using GaN epitaxy on Silicon is increasingly successful, especially for applications at 650V or below. GaN free-standing wafers are also being used to develop components with a vertical geometry which leads to higher power density due to volume instead of surface conduction.

We have developed lateral normally-off GaN-on-Si MOSc-HEMTs (Metal Oxide Semiconductor channel HEMTs). Their advantage comes from the insulated gate technology results in extremely low gate current and a reduced temperature coefficient of its On-resistance, both of which are beneficial for the design of power converters. We will present a full micro inverter using our 100V and 650V MOSc-HEMTs for inclusion on an individual solar panel (DC 45V / AC 230V). The talk will also cover alternative lateral and vertical device architectures that can allow GaN to address new power conversion applications.

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